ORIGINAL

Factors Associated with Perinatal Mortality in Pregnant Women in Marrakech: Case Control Study

Factores asociados con la mortalidad perinatal en mujeres embarazadas en Marrakech: Estudio de casos y controles

Baslam Abdelmounaim[1] ⓘ, Merrou Soumia[2] ⓘ, Azraida Hajar[1] ⓘ, Belghali Moulay Yassine[3] ⓘ, Ouzennou Nadia[4] ⓘ, Marfak Abdelghafour[5] ⓘ

1. Laboratory of Pharmacology, Neurobiology, Anthropobiology and Environment, Department of Biology, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco.
2. Health Sciences Research Center, Faculty of Medicine and Pharmacy of Marrakech, Cadi Ayyad University, Morocco.
3. Laboratory of Immunology, Research Clinic Center, University Hospital Mohamed VI, Marrakech, Morocco.
4. Higher Institute of Nursing and Health Techniques, Ministry of Health and Social Protection, Rabat, Morocco.
5. National School of Public Health, Rabat, 10000, Morocco.

Corresponding author
Baslam Abdelmounaim
E-mail: baslamounaim@gmail.com

Abstract

Introduction: Perinatal mortality, encompassing fetal deaths from 22 complete weeks of pregnancy until the sixth day after delivery, remains a significant global concern. The early neonatal period is particularly critical, as nearly two-thirds of these deaths occur during this phase. It is estimated that over 4.9 million perinatal deaths occur worldwide, with 98% of them concentrated in low- and middle-income countries.

Subject & Methods: This retrospective case-control study aimed to investigate the factors associated with perinatal mortality. The study surveyed 500 women (N = 500) over a 6-month period in 2019 at the Mohammed VI Hospital, a tertiary care facility in Marrakech, Morocco. Cases comprised women who experienced perinatal mortality, while controls included women who had successful live births. A structured questionnaire was employed to gather data from pregnant women who presented during the study period.

Results: The findings revealed significant associations between perinatal mortality and several factors. Maternal age greater than 35 years (OR = 5.634), nulliparity, the number of antenatal visits, pre-existing morbidities such as hypertension, and prepartum hemorrhage were identified as key risk factors for perinatal mortality.

Conclusion: To improve the survival rates of newborns, it is imperative to implement an effective program to combat neonatal mortality. This can be achieved through various means, including the provision of adequate resources and support. Promoting antenatal care is vital, and can be facilitated by targeted advertising campaigns on mass media and social networks."

Key words: Mortality, perinatality, stillbirth, neonatal, maternal health, Marrakech, Morocco.

Resumen

Introducción: La mortalidad perinatal, que abarca las muertes fetales desde las 22 semanas completas de embarazo hasta el sexto día después del parto, sigue siendo una preocupación global significativa. El período neonatal temprano es particularmente crítico, ya que casi dos tercios de estas muertes ocurren durante esta fase. Se estima que ocurren más de 4.9 millones de muertes perinatales en todo el mundo, con un 98% de ellas concentradas en países de ingresos bajos y medianos.

Sujetos y Métodos: Este estudio retrospectivo de casos y controles tuvo como objetivo investigar los factores asociados con la mortalidad perinatal. El estudio encuestó a 500 mujeres (N = 500) durante un período de 6 meses en 2019 en el Hospital Mohammed VI, un centro de atención terciaria en Marrakech, Marruecos. Los casos incluyeron a mujeres que experimentaron mortalidad perinatal, mientras que los controles fueron mujeres que tuvieron partos vivos exitosos. Se utilizó un cuestionario estructurado para recopilar datos de mujeres embarazadas que se presentaron durante el período de estudio.

Resultados: Los hallazgos revelaron asociaciones significativas entre la mortalidad perinatal y varios factores. La edad materna mayor de 35 años (OR = 5.634), la nuliparidad, el número de visitas prenatales, las morbilidades preexistentes como la hipertensión y la hemorragia preparto se identificaron como factores de riesgo clave para la mortalidad perinatal.

Conclusión: Para mejorar las tasas de supervivencia de los recién nacidos, es imperativo implementar un programa efectivo para combatir la mortalidad neonatal. Esto se puede lograr a través de diversos medios, incluida la provisión de recursos y apoyo adecuados. Promover la atención prenatal es vital y se puede facilitar mediante campañas publicitarias dirigidas en los medios de comunicación masiva y las redes sociales.

Palabras clave: Mortalidad, perinatalidad, mortinato, neonatal, salud materna, Marrakech, Marruecos.

Introduction

Perinatal mortality is defined by the number of fetal deaths from 22 complete weeks of pregnancy until the sixth day after delivery. Worldwide perinatal death is estimated for more than 4.9 million where all of them (98%) are located in low- and middle-income countries[1]. Also, more than 60% of newborn deaths before their first birthday[2]. The world health organization report declare that out of 95 countries 5.9 million deaths occurs among children less than five years of age[3,4]. Neonatal deaths happen primarily on the first day of life (27.2%) and between days 1 and 6 (64.8%) of life[4,5]. The early neonatal period is very critical as nearly two-thirds of these deaths occur during this period[6].

Studies showed also that the most common causes of mortality were prematurity, low birth weight, and birth asphyxia[7]. The health of mothers and their newborns is usually inseparable. Studies have shown that maternal complications during the perinatal period leads to problems such as stillbirths, neonatal morbidity, neonatal asphyxia and neonatal death[8].

Factors related to maternal and infant mortality are: young maternal age, advanced age, under-nutrition, birth interval, maternal health problems during pregnancy, presentation of the child, problems during childbirth such as neonatal causes related to prematurity, mainly acute respiratory syndrome, and non-specified bacterial septicemia, low birth weight, exposure to infections; the low socioeconomic level of the mother is an important underlying risk factor for neonatal death[9,10,11].

The main objective of this study is to contribute to a better understanding of the factors associated to perinatal health in Morocco.

Subjects and Methods

Ethics Statement:
The study was authorized by Mohammed VI University Hospital general directorate (5678/DAP/Cooperation), formal study permission was taken from respective authority. procedures were carried out according to the guidelines of the Declaration of Helsinki. All participants were informed prior to data collection about the purpose of the study. Consent forms were given orally by the participants prior to data collection. anonymity and confidentiality of data were ensured, and the right to withdraw their data from the study.

Study Design
A case control study was conducted with 500 pregnant women, attending university hospital to determine the factors associated to perinatal mortality in Marrakech, Morocco from January to June 019.

Context of the Study
The Marrakech-Safi region is composed from 7 provinces and a prefecture. Located in the center of the country, extended on an area of 39 567 km² and count nearly 4,512,402 inhabitants[12], At the national level, the population of the region represents 13.3% of the national population[13].

The Marrakech-Safi region contains up to 2236949 women representing 49.65% of the general population, women of at procreation age (15-49) represent 51.8% of all women in the region. Married women represent 42.8% with a Synthetic Fertility Rate (FSI) of 2.5. While the parity is 3.8. The female illiteracy rate is 47.6%, whereas only 3.8% of women have a higher level of education. The net activity rate for women is 16.2%[12].

The Marrakech Safi region had the highest number of deliveries in Morocco in 2016 with 43,933 of which 31 died, and the highest number of births expected with 78,64613.

Study Participants and Recruitment
The population in this study is consisted of pregnant women admitted at the obstetric emergency unit for an eventual delivery at the tertiary care Mohammed VI hospital.

After briefing the patients about the study and getting their consent, they were submitted to a structured interview that includes demographic Socio economic and cultural information (such as sex, age, education level, and marital status, profession, economic status), fertile life (age at first marriage, chronology of pregnancies, live births, stillbirth, use of contraception etc.), state of health of women (chronic diseases reported, preconceptual nutritional status, obstetric and gynecologic antecedents) and the result of the current pregnancy (maternal and infant morbidity or mortality complications). Data were completed by consulting medical reports of the patients, in which more information about delivery were obtained such as contractions, postpartum signs, presence of complications, and Apgar score.

Cases are women who had perinatal mortality and controls are ones who had living births. The study population included for each case, two controls.

Inclusion and exclusion criteria
Inclusion criteria:
- Women presenting to gynecological emergencies for a possible delivery
- Women referred from a second level hospital or health center with delivery unit
Exclusion criteria:
- Women who gave birth to a fetus weighing less than 1000 grams.
- Women with an abortion where the gestational age is less than 28 weeks.

2.6 Statistical Analysis

Data was analyzed using SPSS 25.0 software. Categorical data was summarized using frequency, tables and percentages. Continuous variables were summarized using mode, mean and Standard Deviation (SD). Descriptive analysis, frequencies, percentages and rates were calculated. Logistic regression b was used for assessment of risk factors where univariate analysis was done. All factors with P value less than 0.05 in univariate analysis were considered for multivariable analysis in different steps to assess factors which remained as predictors of perinatal mortality. All categories with the lowest risk were used as a reference group in multivariable analysis. it was also used to estimate directly the risk factors instead of odds ratio. 95% confidence intervals (CIs) were estimated in models to determine the association between perinatal mortality and number of explanatory variables. A p value of less than <0.05 was considered statistically significant.

Results

A total of 500 participants were administered the questionnaire, age of women ranged from 14 to 48 Years old (Y). the average age of this group was 26,90 Y (SD=6,86Y), regarding age distribution, the 20-34 age group was the most represented (64.4%), while the remaining 1/3 was divided between the other 2 groups <20 Y and > 35 years, representing 18.4% and 17.2% respectively (**Table I**). 39.6% of the enrolled women (n=195) were illiterate, those with a primary level represented 34.8%, secondary school by 23.2% and only 12 women out of 500 (2.4%) had a higher level of education. According to **table I**, women with age over 35 Y were at risk factor for perinatal mortality: OR 5.6 (2.808-11.306) with statistically significant difference (p<0,000). The education level was negatively correlated to mortality, the most it gets higher the less woman became at risk of perinatal mortality OR0,524 (0,137-0,871) (**Table I**).

Regarding the average age of the first pregnancy, it varied from 13 to 41 years, with an average of 21.24 years (SD=4.73 years) where half of women (53.4%) fell pregnant for the first time before completing 20 Y.

Birth interval: where the inter-reproductive interval, expressed in months, corresponds to the duration that separates two successive births. In the present study: 17.4% had an interval less than 15 month, 21.8% between 15-26 months. While only 11% and 11.8% spaced them between 27-68 months and over 68 months respectively.

Ante-natal consultation: considered to be an important factor in achieving a childbirth with the best possible conditions, most of the women surveyed followed their pregnancies (91.2%), either in the public sector, in the private sector, or both, representing 49.9%, 27.6% and

13.8% respectively. Regarding the number of these consultations, half of the women (49.6%) made 2 to 3 consultations, and 39% more than 4 consultations, while only 2.6% were limited to one (**Table II**).

considering nulliparity as a reference, Parity was a protective factor against mortality: OR of 0.015 (0.003-0.065) if it was primiparous, and OR of 0.053 (0.012-0.230) if it was multiparous.

The birth interval was a risk factor for mortality if it is less than 15 months: OR 10.67 (5,659-20,147), this risk decreased by increasing this interval, OR 4,078 (1,862-8,930) if it is between 15 and 26 months.

The number of antenatal consultations protect the woman against perinatal mortality, compared to those who never followed up, the more woman consulted, the more get protected OR 0.329 (0.171-0.634) in doing 2 to 3 consultations, and OR 0.284 (0.144-0.557) by making more than 4.

During this current study, the prevalence of complications related to pregnancy is 24.2% as maternal morbidity. While hemorrhage affected 11.0% of the women surveyed (N=500), distributed as follows 36% in antepartum (n=55), 14% at the time of delivery and 40% post-partum. While 9% had hemorrhagic shock.

Women, who were followed for hypertension, were 5 times more likely to have perinatal mortality than women without any prior pathology.

Obstetrical antecedents were also risk factors, as: cesarean section OR: 8.20 (3.374-19.934), hemorrhage OR 1.528, and uterine rupture OR 2.691 (**Table III**).

The logistic regression showed that women with an antecedent of perinatal mortality were at higher risk to develop this consequence for a new time during pregnancy OR 136,911 (18,430-1017,089), with statistically significant difference (p<0,000).

Hemorrhage remains a risk factor: in antepartum OR 16,541 (6,360-43,018), and per partum OR 6,616 (1,521-28,786) (**Table IV**).

Discussion

According to the results of this study, the average age at first marriage is 20.37 years (SD 4.69), where 2 in 3 women (62.6%) were married before the age of 20, this finding is in line with a national study where the showed that the mean age oof first marriage is 19.45 years. Our sample is considered younger compared to an international survey conducted by UNICEF where they found only 21% of women were married before the age of 20[14].

Table I: Socio demographic and perinatal mortality among participants.

Variables	Modalities	Cases n (%)	Controls n (%)	OR (CI 95%)	P value
Age groups	<20 (Y)	15 (9.32)	77 (22.71)	1	
	>35 (Y)	45 (27.95)	41 (12.1)	5,634 (2,808-11,306)	0
Education status	Illiterate	77 (47.8)	121 (35.7)	1	-
	Primary school	52 (32.3)	122 (36.0)	0,67 (0,435-1,032)	0,67
	Secondary school	29 (18)	87 (25,7)	0,524 (0,315-0,871)	0,013

Table II: Women's fecundity and perinatal mortality.

Variables	Modalities	Cases n (%)	Controls n (%)	OR (CI 95%)	P value
Parity	0	24 (14,9%)	2 (0.6)	1	
	1	31 (19.3)	178 (52.5)	0,015 (0,003-0,065)	0
	2-abr	93 (57.8)	146 (43.1)	0,053 (0,012-0,230)	0
	>5	13 (8.1)	13 (3.8)	0,083 (0,016-0,427)	0,003
Birth interval	>68 months	27 (16.8)	31 (9.2)	1	-
	<15 months	49 (30.4)	38 (11.2)	10,67 (5.659-20.147)	0
	15-26 months	54 (33.5)	55 (16,3)	4.078 (1.862-8.930)	0
Antenatal consultations	None	25 (15.6)	19 (5.6)	1	-
	Public Sector	76 (47.2)	173 (51.0)	0.348 (0.180-0.673)	0.002
	Private Sector	43 (26.7)	96 (28,3)	0.355 (0.176-0.715)	0.004
	Public and Private	17 (10,.5)	51 (15.0)	0.279 (0.125-0.626)	0.002
Number of Antenatal consultations	None	25 (15.6)	19 (5.6)	1	-
	1	8 (5.0)	5 (1.5)	1.216 (0.343-4.315)	0.762
	2-mar	75 (46.6)	173 (51.5)	0.329 (0.171-0.634)	0.001
	>4	53 (39.0)	142 (41.9)	0.284 (0.144-0.557)	0.000

Table III: Women's health status and perinatal mortality.

Variables	Modalities	Cases n (%)	Controls n (%)	OR (CI 95%)	P value
Preexisting morbidity	None	130 (80,7%)	307 (90.6)	1	
	Anemia	15 (9.3)	21 (6.2)	1.687 (0.843-3.375)	0,14
	Highblood pressure	7 (4.3)	3 (0.9)	5.510 (1.403-21.641)	0,014
	Diabetes	4 (2.5)	4 (1.2)	2.362 (0.582-9.586)	0,229
Obstetrical antecedents	None	108 (67.1)	310 (91.4)	1	-
	Caesarean	20 (12.4)	7 (2.1)	8.201 (3,374-19,934)	0.000
	Hemorrhage	15 (9.3)	2 (0.6)	21,528 (4,844-95,671)	0.000
	Uterine rupture	15 (9.3)	16 (4.7)	2,691 (1,287-5,627)	0.009

Table IV: Pregnancy and perinatal mortality among participants.

Variables	Modalities	Cases n (%)	Controls n (%)	OR (CI 95%)	P value
Antecedent of Perinatal mortality	0	1 (1,8%)	338 (75.7)	1	
	1	32 (60.4)	79 (17.7)	136.911 (18.43-1017.089)	0
	2-abr	19 (35.9)	28 (6.2)	229.357 (29.601-1777.15)	0
	>5	1 (1.8)	2 (0.4)	169 (7.607-3757.485)	0,001
Delivery complications	None	108 (67.1)	310 (91.4)	1	-
	Hemorrhage	15 (28.3)	40 (8.9)	3.165 (1.585-6.322)	0.001
Hemorrhage	0	37 (69,8%)	408 (91.3)	1	
	Antepartum	12 (22.6)	8 (1.8)	16.541 (6.360-43.018)	0
	Perpartum	3 (5.7)	5 (1.1)	6.616 (1.521-28.786)	0,012
	Postpartum	1 (1.9)	21 (4.7)	0.525 (0.069-4.015)	0,535
Cases 53, control 441					

The univariate logistic regression of perinatality and the age of the woman showed that the age of woman (>35 years old) is a significant risk factor OR = 5,634 (2,808-11,306). This result is similar to that was found in Bobo Dioulasso, Burkina Faso by Konate[15], where mothers aged 35 or older are tree times likely to have a perinatal mortality.

Diallo & collegues (2015)[16] reported that high maternal age is a risk factor for perinatal mortality. This finding could be explained by the higher incidence of pregnancy-related diseases in older pregnant women. This is consisted with Édouard et al. (1982)[17] who report that "the pathological risks of pregnancy and childbirth increase with age". While in Senegal, they consider the age range <18 years

or > 34 years as a risk factor that can influence the antenatal care in the first trimester of pregnancy[17].

The univariate logistic regression of perinatality and the socio-demographic characteristics of women and their spouses, for their part, did not show statistic significant associations, this is probably due to the fact that the components of each variable are similar between the two studied groups, namely most of them are of rural origin, a low level of education (the primary) for the majority, exercising self-employed professions with a low monthly income not exceeding 2750 DH. This finding is in line with another study in Essaouira city where they found no statistical significant between literacy and pregnancy morbidity[18].

On the other hand, other studies have confirmed the association between these characteristics and perinatal mortality: Women with a low level of education (primary) and analphabets are those whose children are four times at risk than that of the group of women with a higher level of education. This finding was demonstrated by a study conducted in Guinea by Diallo et al. (2015)[16], where the stillbirth rate for housewives is 52.16‰ and 24.39‰ among the employed one, a rate of 2,13 times higher. This result could be explained by several facts: housewives represent the majority of the female class; in general, they are illiterate and, for the most part, poor, and have little or no health education in particular reproductive health.

The present study has shown very strong associations between perinatal mortality and antenatal care, especially the number of consultations, which is a protective factor. The more woman does prenatal consultations, the more she protects herself, OR 0.284 (0.144- 0.557) as the reference those who have never done a consultation. The low number of antenatal consultations increases the risk of having infant mortality/morbidity[19]. On the other hand, some studies suggest that the number of visits is less important than the quality of the consultation[20].

The rate of perinatal mortality is negatively correlated with prenatal consultations, this finding is consistent with other studies, according to Diallo et al.2015, women with no history of prenatal consultation had higher rates of perinatal mortality compared to the others, representing 110.36‰ against 36.23‰ respectively. As reported also by another study, where mother whom never followed accounted double mortality rates[21].

The results of the study showed a strong association between perinatal mortality and parity of the woman, which is a protective factor-. The same result is found in a study conducted by Diarra (2007)[30] in Mali at the G-Point hospital, which lasted for 19 years (from 1985 to 2003), showing that parity against this event is protective factor: OR 0.75 . But according to other studies parity becomes risk factor when the woman exceeds 6 children called

otherwise grand multiparous. Rekik et al., (1986)[25] in Tunisia reported that grand multiparity multiplied by four the risk of stillbirths.

The study has shown that nulliparity is risk factor for perinatal mortality, and this latter decreases with parity, this finding is consistent with a study done in Australia by Bai et al., (2002)[22], where they found that the risk of perinatal death was significantly higher among the nulliparity women. Primigravid women have different labors and have their own pregnancy complications. The primigravid women have much higher rates of maternal complications, and the infants born to primigravid women show high rates of neonatal morbidity.

The present study found a strong association of the perinatal mortality with the morbidities which the woman suffers, this is confirmed by a study conducted by Ouahid et al. (2019)[23] at the same hospital and another one undertaken in guinea (Donka university Hospital), by Bah et al. (2001)[24] where they showed the correlation of Hypertension with perinatal and also maternal complications, the same study was able to note that the antihypertensive treatment did not protect against the said complications[24]. This finding is consisted with the study of Rekik et al.[25], where they mentioned that preexisting morbidities such as diabetes, hypertension and also nulliparity doubles the risk of perinatal mortality[26].

Gestational diabetes represents 2.5% in the present study, which is considered low in comparison with some other national studies where they found 9.7% in Essaouira(18), between 8.2 and 10% in Rabat[27].As for the international level it affects 25% of the population of the western pacific[28].

The predominance of hypertension as a major etiologic factor in our series study may be due to the lack or low quality of prenatal care associated with either failure to detect pregnancy at risk of hypertension or poor management of hypertension. This finding is in line with the national survey on population and health family, published by the ministry of health and health promotion, where they declare hypertensive disorders as a major pregnancy disorder[29].

The obstetrical antecedent of hemorrhage, caesarean section and uterine rupture are also associated with perinatal mortality, these results are in full concertation with those of Diarra[30].

Third trimester hemorrhage refers to vaginal external bleeding during the third trimester of pregnancy from 28 weeks of amenorrhea and constitutes an obstetric emergency with risk of maternal and fetal morbidity and mortality. In this study hemorrhage of antepartum and per partum accounted as an inseparable risk factor in perinatal mortality of either OR 16.541 (6.360- 43.018),

and 6.616 (1.521-28.786) respectively. This finding is confirmed by several studies: a study conducted at Avicenne University Hospital (Rabat, Morocco)by Izrar (2016)[31], where they found antepartum hemorrhage represents 19.46% of perinatal mortality

While another study conducted in the Congo by alfred et al. (2016)[32] among the women who had hemorrhage, 28% of them had stillbirths.

The survey also found that the antecedent of perinatal mortality is also a risk factor in which the pregnant woman could live another drama, this result is confirmed by a study conducted in Burkina Faso by Ouedraogo (2001)[33] ,and another study conducted in Madagascar by Rakotoseheno et al. (2008)[34].

To this time, the Ministry of Health in Morocco has implemented an approach allowing the improvement of women's knowledge and attitudes on several topics. It,s called the "Mothers' Class" approach in all health facilities, which consists on organizing group educational sessions adapted to pregnant women and women who have given birth[29].

Methodological Limitations
1. The study was conducted in a "hospital-clinical population" which might have introduced a selection bias in the study. For example, the majority of patients were urban dwellers. This is an inadvertent reality in most studies and requires caution in interpreting findings. A community-based study would be the solution to this bias.
2. The sample was heterogenous. pregnant women with hight educational level were not excluded , high economic level or residency aria. Thus, some peculiarities of subgroups might have confounded general results.
3. A relatively small sample was used to investigate the perinatal mortality and all the risk factors of pregnancy were not considered.

Recommendations
Resulting from our findings, some measures should be taken in order to decrease the rate of prenatal mortality, such as promoting antenatal follow-up through advertising spots on the mass media and social networks to educate mothers. Also, the Implementation of a program to combat neonatal mortality by providing it with sufficient means. Further epidemiological studies should be taken in order to evaluate the psychosocial impact of prenatal mortality on the mothers and the society. Also, other experimental studies should be conducted in the perspective of finding other biological factors that could interfere with a normal pregnancy.

Conclusion
This case-control study, conducted at the mother-child hospital (university hospital) among 500 women with homogeneous characteristics, and which focuses on the health of the mother and her child, paid particular attention to perinatality.

According to the results found, the indicators are still high, namely the perinatal mortality rate.

On the other hand, modeling has shown that factors such as maternal age, nulliparity, birth interval, perinatal mortality history, number of antenatal visits, and per partum hemorrhage, are found to be the most associated to perinatal mortality.

To improve the survival of our newborns, as in the case of maternal health, we need to put in place a real program to combat neonatal mortality by providing it with sufficient means, thus promoting antenatal follow-up through advertising spots on the mass media and social networks.

Conflict of Interest
This study was neither funded nor sponsored by any agency or pharmaceutical firm. The authors undertake that there is no conflict of interest, whatsoever with anyone.

References

1. Oza S, Lawn JE, Hogan DR, Mathers C, Cousens SN. Neonatal cause-of-death estimates for the early and late neonatal periods for 194 countries: 2000-2013. Bull World Health Organ. 2015 Jan 1;93(1):19-28.

2. Kedy DC, Essomba NE, Ngaba GP, Sintat S, Ndombo PK, Coppieters Y. Morbidité et facteurs de risque de mortalité néonatale dans un hôpital de référence de Douala. Pan Afr Med J [Internet]. 2015

[cited 2020 May 23];20. Available from: http://www.panafrican-med-journal.com/content/article/20/258/full/

3. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet Lond Engl. 2015 Jan 31;385(9966):430-40.

4. Organization WH. Integrated management of childhood illness global survey report. World Health Organization; 2017.

5. Erchick DJ, Lackner JB, Mullany LC, Bhandari NN, Shedain PR, Khanal S, et al. Causes and age of neonatal death and associations with maternal and newborn care characteristics in Nepal: a verbal autopsy study. Arch Public Health. 2022 Jan 11;80(1):26.

6. Gaíva MAM, Bittencourt RM, Fujimori E. [Early and late neonatal death, characteristics of mothers and newborn]. Rev Gaucha Enferm. 2013 Dec;34(4):91-7.

7. Mohamed HA, Shiferaw Z, Roble AK, Kure MA. Neonatal mortality and associated factors among neonates admitted to neonatal intensive care unit at public hospitals of Somali Regional State, Eastern Ethiopia: A multicenter retrospective analysis. PLOS ONE. 2022 May 26;17(5):e0268648.

8. Zelka MA, Yalew AW, Debelew GT. The effects of completion of continuum of care in maternal health services on adverse birth outcomes in Northwestern Ethiopia: a prospective follow-up study. Reprod Health. 2022 Oct 8;19(1):200.

9. Conde-Agudelo A, Rosas-Bermúdez A, Kafury-Goeta AC. Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. JAMA. 2006 Apr 19;295(15):1809-23.

10. Lawn JE, Cousens S, Zupan J, Lancet Neonatal Survival Steering Team. 4 million neonatal deaths: when? Where? Why? Lancet Lond Engl. 2005 Mar 5;365(9462):891-900.

11. Kreutz IM, Santos IS. Contextual, maternal, and infant factors in preventable infant deaths: a statewide ecological and cross-sectional study in Rio Grande do SUL, Brazil. BMC Public Health. 2023 Jan 12;23(1):87.

12. RGPH 2014 | Téléchargements | Site institutionnel du Haut-Commissariat au Plan du Royaume du Maroc [Internet]. [cited 2022 Nov 30]. Available from: https://www.hcp.ma/downloads/RGPH-2014_t17441.html

13. RGPH 2014 [Internet]. [cited 2020 May 23]. Available from: http://rgphentableaux.hcp.ma/Default1/

14. Child marriage [Internet]. [cited 2023 Feb 26]. Available from: https://www.unicef.org/protection/child-marriage

15. Konate MTA. Mortinatalité à la maternité de l'Hôpital de Sikasso. 2009;82.

16. Diallo FB, Baldé IS, Diallo BS, Diallo A, Baldé O, Conté I, et al. Mortinatalité : aspects sociodémographiques à l'hôpital régional de Kindia en Guinée. Rev Médecine Périnatale. 2015 Sep;7(3):187-91.

17. N'Diaye P, Dia AT, Diediou A, Dieye EHL, Dione DA. Déterminants socioculturels du retard de la 1re consultation prénatale dans un district sanitaire au Sénégal. Santé Publique. 2005;17(4):531-8.

18. Manoussi A, Baali A, Amor H, Ouzennou N. Pregnancy morbidity: Situation and determinants in the province of Essaouira - Morocco-. SHS Web Conf. 2021;119:06004.

19. Sabiri N, Kabiri M, Razine R, Barkat A. Risk factors leading to preterm births in Morocco: a prospective study at the maternity Souissi in Rabat. Pan Afr Med J [Internet]. 2015 [cited 2020 May 30];22. Available from: http://www.panafrican-med-journal.com/content/article/22/21/full/

20. Idiard-Chamois B. Gynécologie, parentalité et handicap, histoire d'une consultation. Sages-Femmes. 2022 Nov 1;21(6):15-9.

21. Thoullon JM. La mortalité périnatale dans les pays industrialisés. Ile Rapp Au 2e Congrès Panafricain Société Afr Gynécologie Obstétrique Conakry. 1992;14-8.

22. Bai J, Wong FWS, Bauman A, Mohsin M. Parity and pregnancy outcomes. Am J Obstet Gynecol. 2002 Feb;186(2):274-8.

23. Ouahid H, Adarmouch L, Belouali R, Mouwafaq S, Soummani A. Les facteurs associés à la mortalité intrapartum et néonatale très précoce au niveau de la maternité du centre hospitalier universitaire Mohammed VI, Marrakech, Maroc. Étude cas témoin. Rev DÉpidémiologie Santé Publique. 2019 Jul;67(4):233-8.

24. Bah AO, Diallo MH, Conde AM, Keita N. Hypertension artérielle et grossesse: mortalité maternelle et périnatale. Médecine D'Afrique Noire. 2001;48(11):461-4.

25. Rekik A, Rekik R, Rekik S, FOURATI A, ZOUARI A. La mortinatalité et ses facteurs de risque à la maternité de Sfax. Tunis Médicale. 1986;64(11):909-12.

26. Benfateh M, Cissoko S, Boufettal H, Feige JJ, Samouh N, Aboussaouira T, et al. Risk factors and poor prognostic factors of preeclampsia in Ibn Rochd University Hospital of Casablanca: about 401 preeclamptic cases. Pan Afr Med J [Internet]. 2018 [cited 2020 May 30];31. Available from: http://www.panafrican-med-journal.com/content/article/31/225/full/

27. Bouhsain S, El Kochri S, Babahabib MA, Hafidi MH, Bouaiti E, Moussaoui MD. Comparaison de deux politiques de dépistage du diabète gestationnel : expérience de l'hôpital militaire d'instruction Mohammed V de Rabat (Maroc). Gynécologie Obstétrique Fertil. 2014 May 1;42(5):317-21.

28. Gon G, Leite A, Calvert C, Woodd S, Graham WJ, Filippi V. The frequency of maternal morbidity: A systematic review of systematic reviews. Int J Gynaecol Obstet Off Organ Int Fed Gynaecol Obstet. 2018 May;141 Suppl 1(Suppl Suppl 1):20-38.

29. Guides & Manuels [Internet]. [cited 2023 Feb 26]. Available from: https://www.sante.gov.ma/Publications/Guides-Manuels/Pages/default.aspx

30. DIARRA S. Prévalence et facteurs de risque de la mortinatalité dans le service de gynécologie obstétrique de l'hôpital national Point G entre 1985 et 2003 [PhD Thesis]. Thèse de Médecine, Bamako; 2007.

31. Izrar N. Les hémorragies du troisième trimestre de la grossesse à la Maternité Universitaire Souissi de Rabat à propos de 110 cas. [Internet] [Thesis]. 2016 [cited 2019 Jun 22]. Available from: http://ao.um5.ac.ma/xmlui/handle/123456789/15273

32. Alfred MJ, Foromo H, Wilhem AG, Hervé IL. Prise En Charge Des Hémorragies Du Troisième Trimestre De La Grossesse Au Centre Hospitalier Et Universitaire De Brazzaville. Glob J Med Res. 2016;

33. Ouedraogo C, Testa J, Sondo B, Kone B. al. Analyse des facteurs de risque de morbidité maternelle severe à Ouagadoudou, au Burkina Faso. Médecine D'Afrique Noire. 2001;48(10):67-9.

34. Rakotoseheno H, Rakotonirina EJ, Randriatsarafara FM, Rakotonantoanina J, Randrianarimanana VD, Rakotomanga JDM, et al. Consultations prénatales et mortalité périnatale à Madagascar. J Gynécologie Obstétrique Biol Reprod. 2008 Sep;37(5):505-9.